time series results indicate that more *in situ* time series data sets such as those described here along with focused process-oriented eddy experiments (e.g., recent EDDIES experiment off Bermuda and E-Flux off Hawaii), devoted to the ecology, community structure, and biogeochemistry as well as the physics of mesoscale eddies are essential for future progress.

4.3. Effects of wind events

There is increasing interest in the effects of high wind and especially hurricanes on the ocean. Our study region is ideal for such research. Because of the difficulty of sampling with ships during major wind events, moored observations are important. Early indications suggest that there are likely a variety of physical parameters, which need to be considered in determining how upper ocean biology will respond. Already, some investigators have provided evidence of induced phytoplankton blooms in the wakes of hurricanes in the North Atlantic (i.e., Babin et al., 2004). Fewer data are available to determine effects upon zooplankton. Our data sets, though rather limited for making broad conclusions, suggest that at least major hurricanes such as Hurricane Fabian may result in deeper distributions of zooplankton and possibly reduced depth-integrated zooplankton biomass. It is possible that the increased mixing distributed zooplankton deeper and also advected some of the biomass away from the sampling site. We suggest that some wind speed threshold must be reached for there to be major effects on zooplankton distributions in the upper ocean, and thus effects on zooplankton in our study were only notable during this strong hurricane in close proximity to the BTM site. Observations of more hurricane events should help to determine if this apparent phenomenon was aberrant or the norm.

4.4. Diel vertical migration patterns

The seasonal modulation of the diel vertical migration of zooplankton is very evident in our high-resolution data. In springtime, zooplankton biomass is generally high in the upper layer and decreases with depth and there is strong vertical migration at sunrise and sunset. The estimated maximum relative vertical velocity computed using an ensemble average of 14-day time series of data occurred in spring with a value of 5.4 $cm\,s^{-1}$. This value is comparable to results presented by other researchers as summarized by Luo et al., 2000): 1–4 $cm\,s^{-1}$ (Plueddemann and Pinkel, 1989), 3–8 $cm\,s^{-1}$ (Smith et al., 1989), 2–4 $cm\,s^{-1}$ (Roe and Griffiths, 1993), 2–6 $cm\,s^{-1}$ (Heywood, 1996), and maximum of 10 $cm\,s^{-1}$ (Luo et al., 2000). Diel migration patterns for the summer period are evident, but vertical migration speeds are slower than in the spring. In the fall, there is a persistent, strong subsurface maximum layer during the night. In winter, diel migration is less pronounced compared with the other seasons, and there is only weak structure in zooplankton biomass distribution, likely explained by deeper wintertime mixed layers.

The high-resolution nature of our sampling enabled us to examine the annual modulation of diel migration and acoustic backscatter. These data clearly illustrate how the length of daylight modulates the timing of the zooplankton migration. Migratory ascents occur earlier in the evening (backscatter intensity increases), and descents take place later in the morning in winter compared to summer. Seasonality of diel migration was also explored by Fischer and Visbeck (1993) using an ADCP in the Greeenland Sea. As expected at this high latitude site, the timing and intensity of diel migration was considerably more variable over an annual cycle than in the Sargasso Sea, with diel migration dampened in mid-summer and winter and pronounced in the periods in between. The specific timing of peak downward and upward migration velocity relative to the times of sunrise and sunset was documented for the first time at our site, with most frequent downward movements beginning about 40 min before sunrise and upward movements beginning about a half an hour after sunset. Vertically migrating zooplankton play an important role in biogeochemical cycling as they can actively transport a significant amount of dissolved inorganic and organic carbon and nitrogen to the deep sea (e.g., Longhurst et al., 1990; Steinberg et al., 2000, 2002; Al-Mutairi and Landry, 2001). These high-resolution data showing diel changes in zooplankton biomass will help constrain estimates of active transport of carbon and nitrogen to the deep sea via zooplankton migration.

To conclude, long-term BTM observations with acoustic zooplankton biomass measurements will play an important role in understanding zooplankton biomass variability with episodic events (e.g., eddy passages, wind mixing) and diel zooplankton migrator patterns in the Sargasso Sea, and can facilitate studies of physical and biological interactions and biogeochemical cycling.